2011 Mississippi Curriculum Framework

Postsecondary Diagnostic Medical Sonography Technology

(Program CIP: 51.0910 – Diagnostic Medical Sonography/Sonographer and Ultrasound)

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Standards in this document are based on information from the following organizations:

CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography	Reprinted with permission from the Commission on Accreditation of Allied Health Education Programs (CAAHEP), 2007.
Related Academic Standards	CTB/McGraw-Hill LLC. (2005). *Tests of adult basic education, forms 9 and 10.* Monterey, CA: Author. Reproduced with permission of CTB/McGraw-Hill LLC. TABE is a registered trademark of The McGraw-Hill Companies, Inc. Copyright © 2005 by CTB/McGraw-Hill LLC. Reproduction of this material is permitted for educational purposes only.
21st Century Skills	Reproduced with permission of the Partnership for 21st Century Skills. Further information may be found at www.21stcenturyskills.org

Preface

Articles, books, Web sites, and other materials listed at the end of each course were considered during the revision process. The *Journal of Diagnostic Medical Sonography* was especially useful in providing insight into trends and issues in the field. These references are suggested for use by instructors and students during the study of the topics outlined.

Industry advisory team members from colleges throughout the state were asked to give input related to changes to be made to the curriculum framework. Specific comments related to soft skills needed in this program included communication, teamwork, eagerness, perseverance, analytical capability, emotional stability, physical fitness of operator, dedication, appropriate dress, initiative/work ethic, compassion, and flexibility. Occupation-specific skills stated included scanning ability/technical ability, working with computerized equipment, infection control, performing patient assessment and direct patient care, and acquiring and analyzing data. Safety practices emphasized included following OSHA guidelines, using protective gear, and adhering to standard precautions.

Instructors from colleges throughout the state were also asked to give input on changes to be made to the curriculum framework. Comments included the need for more anatomy classes as well as a need for updated technology. Instructors also communicated a need for computerized testing and more advanced and specialized content in the curriculum such as musculoskeletal and Advance Sonography.

Needs of the Future Workforce

The employment of Diagnostic Medical Sonographers is expected to grow faster than average in Mississippi, 19%, and about as fast as average in the United States, 15%, over the 2010 through 2020 projection decade (EMSI, 2011). Job prospects will be favorable for all sonographers. However, sonographers willing to locate as well as sonographers holding multiple credentials and having multiple specialties will have the best job prospects. Hospitals will continue to employ the majority of diagnostic medical sonographers, but other health-care facilities are projected to increase their use of sonographers due to emerging technologies facilitating outpatient treatment (US Bureau of Labor Statistics, 2011).

Diagnostic Medical Sonography Technology Employment Projections and Earnings

Region	2010 Jobs	2020 Jobs	Change	% Change	Openings	2010 Median Hourly Earnings
Regional Total	450	535	85	19%	151	$24.68
National Total	52,231	60,090	7,859	15%	15,634	$30.27

Source: EMSI Complete Employment - 1st Quarter 2011

Curriculum

The following national standards were referenced in each course of the curriculum:

- CTB/McGraw-Hill LLC Tests of Adult Basic Education, forms 9 and 10 Academic Standards
- *21st Century Skills*
- *CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography*

Industry and instructor comments, along with current research, were considered by the curriculum revision team during the revision process; and changes were made as needed and appropriate. Many of the skills and topics noted in the research were already included in the curriculum framework. Specific changes made to the curriculum at the date curriculum revision meeting included the following:

- Competencies and objectives were reviewed to ensure accuracy and appropriateness.
- The Recommended Tools and Equipment list was updated.
- Anatomy and Physiology I and II were established as pre-requisites to the program and are no longer co-requisites.
- College Algebra is now required instead of Intermediate Algebra.

Assessment

This program is assessed using *American Registry for Diagnostic Medical Sonographers.* http://www.ardms.org/default.asp?ContentID=30

No alternate assessment has been approved at this time.

Professional Learning

It is suggested that instructors participate in professional learning related to the following concepts:

- How to use the program Blackboard site
- Differentiated instruction – To learn more about differentiated instruction, please go to http://www.paec.org/teacher2teacher/additional_subjects.html, and click on Differentiated Instruction. Work through this online course, and review the additional resources.

Program Exceptions

No program exceptions exist at this time.

Foreword

As the world economy continues to evolve, businesses and industries must adopt new practices and processes in order to survive. Quality and cost control, work teams and participatory management, and an infusion of technology are transforming the way people work and do business. Employees are now expected to read, write, and communicate effectively; think creatively, solve problems, and make decisions; and interact with each other and the technologies in the workplace. Career–technical programs must also adopt these practices in order to provide graduates who can enter and advance in the changing work world.

The curriculum framework in this document reflects these changes in the workplace and a number of other factors that impact local career–technical programs. Federal and state legislation calls for articulation between high school and community college programs, integration of academic and career skills, and the development of sequential courses of study that provide students with the optimum educational path for achieving successful employment. National skills standards, developed by industry groups and sponsored by the U.S. Department of Education and Labor, provide career and technical educators with the expectations of employers across the United States. All of these factors are reflected in the framework found in this document.

Referenced throughout the courses of the curriculum are the 21st Century Skills, which were developed by the Partnership for 21st Century Skills, a group of business and education organizations concerned about the gap between the knowledge and skills learned in school and those needed in communities and the workplace. A portion of the 21st Century Skills addresses learning skills needed in the 21st century, including information and communication skills, thinking and problem-solving skills, and interpersonal and self-directional skills. Another important aspect of learning and working in the 21st century involves technology skills. The International Society for Technology in Education, developer of the National Educational Technology Standards (NETS), was a strategic partner in the Partnership for 21st Century Skills.

Each postsecondary program of instruction consists of a program description and a suggested sequence of courses that focus on the development of occupational competencies. The MS-CPAS2 blueprints are based upon the suggested course sequences to allow for year 1 and year 2 assessments for all exit options. Please refer to the blueprint online. Each career–technical course in this sequence has been written using a common format, which includes the following components:

- Course Name – A common name that will be used by all community and junior colleges in reporting students

- Course Abbreviation – A common abbreviation that will be used by all community and junior colleges in reporting students

- Classification – Courses may be classified as the following:
    - Career–technical core – A required career–technical course for all students
    - Area of concentration (AOC) core – A course required in an area of concentration of a cluster of programs
    - Career–technical elective – An elective career–technical course
    - Related academic course – An academic course that provides academic skills and knowledge directly related to the program area

  - Academic core – An academic course that is required as part of the requirements for an associate's degree

- Description – A short narrative that includes the major purpose(s) of the course and the recommended number of hours of lecture and laboratory activities to be conducted each week during a regular semester

- Prerequisites – A listing of any courses that must be taken prior to or on enrollment in the course

- Corequisites – A listing of courses that may be taken while enrolled in the course

- Competencies and Suggested Objectives – A listing of the competencies (major concepts and performances) and the suggested student objectives that will enable students to demonstrate mastery of these competencies

The following guidelines were used in developing the program(s) in this document and should be considered in compiling and revising course syllabi and daily lesson plans at the local level:

- The content of the courses in this document reflects approximately 75% of the time allocated to each course. The remaining 25% of each course should be developed at the local district level and may reflect the following:
  - Additional competencies and objectives within the course related to topics not found in the state framework, including activities related to specific needs of industries in the community college district
  - Activities that develop a higher level of mastery on the existing competencies and suggested objectives
  - Activities and instruction related to new technologies and concepts that were not prevalent at the time the current framework was developed or revised
  - Activities that include integration of academic and career–technical skills and course work, school-to-work transition activities, and articulation of secondary and postsecondary career–technical programs
  - Individualized learning activities, including work-site learning activities, to better prepare individuals in the courses for their chosen occupational areas

- Sequencing of the course within a program is left to the discretion of the local district. Naturally, foundation courses related to topics such as safety, tool and equipment usage, and other fundamental skills should be taught first. Other courses related to specific skill areas and related academics, however, may be sequenced to take advantage of seasonal and climatic conditions, resources located outside of the school, and other factors.

- Programs that offer an Associate of Applied Science degree must include a minimum 15-semester-credit-hour academic core. Specific courses to be taken within this core are to be determined by the local district. Minimum academic core courses are as follows:
  - 3 semester credit hours (sch) Math/Science Elective
  - 3 semester credit hours Written Communications Elective
  - 3 semester credit hours Oral Communications Elective
  - 3 semester credit hours Humanities/Fine Arts Elective

- 3 semester credit hours Social/Behavioral Science Elective

It is recommended that courses in the academic core be spaced out over the entire length of the program, so that students complete some academic and career–technical courses each semester. Each community or junior college has the discretion to select the actual courses that are required to meet this academic core requirement.

- Career–technical elective courses have been included to allow community colleges and students to customize programs to meet the needs of industries and employers in their area.

In order to provide flexibility within the districts, individual courses within a framework may be customized by doing the following:

- Adding new competencies and suggested objectives
- Revising or extending the suggested objectives for individual competencies
- Adjusting the semester credit hours of a course to be up 1 hour or down 1 hour (after informing the Mississippi Community College Board [MCCB] of the change)

In addition, the curriculum framework as a whole may be customized by doing the following:

- Resequencing courses within the suggested course sequence reflecting the new assessment format
- Developing and adding a new course that meets specific needs of industries and other clients in the community or junior college district (with MCCB approval)
- Utilizing the career technical elective options in many of the curricula to customize programs

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Program Description

Diagnostic Medical Sonography uses high frequency sound waves to produce images of organs, masses, fluid collections, and vascular structures within the human body. Sonography is user-dependent, requiring competent and highly skilled professionals to be a part of the integral health care system. Sonographers have extensive, direct patient contact, providing care to a variety of people from healthy to critically ill. The sonographer is responsible for obtaining pertinent patient history, performing the sonographic examination, providing for the needs and comfort of the patient during examination, and recording anatomy and pathology or other data for interpretation by the supervising physician to aid in diagnosis. Sonography is commonly used in the field of obstetrics and gynecology for purposes ranging from confirming and/or dating pregnancies to diagnosing disease processes of the female reproductive system. Sonographers must have knowledge of normal structure and functional anatomy of the human body and use independent judgment in recognizing the need to perform procedures according to sonographic findings.

Upon completion of the 2-year program of study, the student will be awarded the Associate of Applied Science degree.

Until a Diagnostic Medical Sonography program reaches accreditation approval from CAAHEP, the students must meet the following criteria in order to apply to sit for the *American Registry for Diagnostic Medical Sonographers*:

- Be a graduate from a 2-year allied health program that is patient care related that includes but is not limited to Diagnostic Medical Sonography, Radiologic Technology, Respiratory Therapy, Registered Nurse, Occupational Therapy, and Physical Therapy; and have 12 months of full-time clinical ultrasound/vascular experience.
- Hold a Bachelor's degree and have 12 months of full-time clinical ultrasound/vascular experience.

Graduates from a CAAHEP accredited Diagnostic Medical Sonography Program may apply to take the ARDMS without further experience.

Industry standards referenced are from the *CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography* (2007).

Suggested Course Sequence*
Diagnostic Medical Sonography Technology**
Associate of Applied Science Degree

Prerequisites: 4 sch Anatomy and Physiology I (with lab) (BIO 1514)
4 sch Anatomy and Physiology II (with lab) (BIO 1524)

FIRST YEAR

4 sch	Survey of Physics I (PHY 1214)
3 sch	Math/Science Elective
3 sch	Written Communications Elective
4 sch	Introduction to Ultrasound (DMS 1114)
14 sch	

3 sch	Ultrasound Physics and Instrumentation I (DMS 1313)
3 sch	Fine Arts/Humanities Elective
3 sch	Social/Behavioral Science Elective
3 sch	Medical Terminology in Allied Health (TAH 1113)***
12 sch	

SECOND YEAR

3 sch	Oral Communications Elective
3 sch	Introduction to Computer Concepts (CSC 1113)
3 sch	Sectional Anatomy (DMS 1213)
4 sch	Clinical Experience I (DMS 1414)
13 sch	

3 sch	Abdominal Sonography (DMS 1513)
3 sch	Obstetrical and Gynecological Sonography (DMS 1523)
3 sch	Advanced Sonographic Procedures (DMS 1533)
6 sch	Clinical Experience II (DMS 1426)
3 sch	Ultrasound Physics and Instrumentation II (DMS 1323)
18 sch	

SUMMER SEMESTER

6 sch	Clinical Experience III (DMS 1436)
3 sch	Sonography Seminar (DMS 1613)
3 sch	Ultrasound Examination Critique (DMS 1623)
12 sch	

Applicants without a 2-year allied health patient care related degree must take basic patient care and medical-legal ethics courses.

* For students without a 2-year allied health degree. This sequence can only be used with a two-instructor program.

** Students who lack entry-level skills in math, English, science, and so forth will be provided related studies.

*** May be waived for completers of postsecondary allied health programs

Suggested Course Sequence
Diagnostic Medical Sonography Technology

Certificate Option

The certificate option is designed for students who are graduates of 2-year allied health patient care related programs and who have passed the corresponding certification exam. This includes associate degree nursing, radiologic technology, physical therapy assistant, respiratory therapy, occupational therapy assistant, or a Bachelor of Science degree that includes basic patient care and medical-legal ethics. Prerequisites include Anatomy and Physiology I & II, Survey of Physics I*, College Algebra, and Oral Communications or English Composition.

FIRST YEAR

4 sch	Introduction to Ultrasound (DMS 1114)
3 sch	Sectional Anatomy (DMS 1213)
3 sch	Ultrasound Physics and Instrumentation I (DMS 1313)
4 sch	Clinical Experience I (DMS 1414)
14 sch	

3 sch	Abdominal Sonography (DMS 1513)
3 sch	Obstetrical and Gynecological Sonography (DMS 1523)
3 sch	Advanced Sonographic Procedures (DMS 1533)
6 sch	Clinical Experience II (DMS 1426)
3 sch	Ultrasound Physics and Instrumentation II (DMS 1323)
18 sch	

SUMMER SEMESTER

6 sch	Clinical Experience III (DMS 1436)
3 sch	Sonography Seminar (DMS 1613)
3 sch	Ultrasound Examination Critique (DMS 1623)
12 sch	

* May be met by radiographic physics or survey of physics courses

Diagnostic Medical Sonography Technology Courses

Course Name: Introduction to Ultrasound

Course Abbreviation: DMS 1114

Classification: Career-Technical Core

Description: Students will be introduced to ultrasound equipment. Cleaning and disinfectant procedures will be shown. Types of film, paper printers, video recorders, scanning tables, ultrasound probes, and recording methods will be discussed. Legal/ethical issues and patient contact within the ultrasound department, as well as scanning protocols, are included. Students will learn the sonographer's role in patient care. (4 sch: 3-hr lecture, 2-hr lab)

Prerequisite: Professional level CPR certification, Anatomy and Physiology I (with lab) (BIO 1514), Anatomy and Physiology II (with lab) (BIO 1524), College Algebra (MAT 1313), Survey of Physics I (PHY 1213), and Medical Terminology in Allied Health (TAH 1113)

Competencies and Suggested Objectives

1. Describe the role, organization, and structure of the ultrasound program, ultrasound department, hospital, or clinic as well as the profession. DMSC1, DMSC2, DMSC7, DMSC9, DMSD8
   a. State the rules and regulations of the ultrasound program regarding class attendance, grading, vacation/sick leave, and the appeals procedure.
   b. Discuss the departmental and hospital/clinic rules and regulations that directly and indirectly affect ultrasound students.
   c. List the major duties and responsibilities of an ultrasound student.
   d. Define the *Essentials and Guidelines of an Accredited Educational Program for the Sonographer* and its purpose.
   e. State policies concerning communicable disease and pregnancy for ultrasound students.
   f. Identify other health science professions that impact the total health care provided to ultrasound patients.
   g. Describe the relationship of ultrasound health-care workers to the integrated care of patients.
   h. Identify key personnel, and discuss their function in the ultrasound department.
   i. Define accreditation, credentialing, certification, licensure, and regulations associated with ultrasound.
   j. Describe how the information in *JRCDMS Standards and Guidelines for an Accredited Educational Program for the Sonographer* relates to the ultrasound program.
   k. Explain the difference between the accreditation and credentialing processes, and identify agencies involved in each process associated with ultrasound.
   l. Describe purposes, functions, and activities of professional organizations associated with ultrasound.
   m. Identify international, national, state, and local organizations for the sonographer.
   n. Discuss general employment outlook and economic return for the sonography graduate.

o. Discuss career advancement and opportunities for the sonographer.
p. Identify benefits of continuing education of the sonographer.

2. Assess and resolve ethical issues and dilemmas in health care. DMSC7, DMSC8, DMSD8
   a. Describe the major milestones in the development of codes of behavior and ethical standards in the healing arts.
   b. Identify the significance of health-care professions.
   c. Recognize the moral, social, and cultural basis of the development of an ethic.
   d. Discuss the role of ethical behavior in health-care delivery.
   e. Differentiate between empathetic and sympathetic involvement in relationships with patients.
   f. Identify concepts of personal honesty, integrity, accountability, competence, and compassion as ethical imperatives in health care.
   g. Recognize situations and conditions that give rise to ethical dilemmas in health care.
   h. Discuss the legal implications of professional liability, malpractice, professional negligence/carelessness, and other legal doctrines applicable to professional practice.
   i. Discuss the significance of accurate, complete, and correct methods of medical record keeping as a legal/ethical imperative.
   j. Articulate responses to theoretical situations and questions relating to the ethics of care and health-care delivery.

3. Identify legal responsibilities related to the scope of practice for sonography. DMSC1, DMSC7
   a. Define the scope of practice for the diagnostic medical sonographer.
   b. Identify the requirements of the sonographer according to the scope of practice.

4. Describe clinical practice standards in diagnostic ultrasound. DMSC1, DMSC2, DMSC3, DMSC4, DMSC5, DMSC8, DMSD1, DMSD2, DMSD3, DMSD4, DMSD5, DMSD6, DMSD7
   a. Identify patient history and correlate with the sonographic procedure requested.
   b. Determine patient ability to tolerate the sonographic procedure.
   c. Evaluate any contraindications to the sonographic procedure such as medications, inappropriate patient preparation, or unwillingness of the patient to tolerate the sonographic procedure.
   d. Explain the sonography procedure to the patient and respond to patient questions.
   e. Refer specific diagnostic, treatment, or prognosis questions to the patient's physician.
   f. Develop a procedure plan for the sonographic exam.
   g. Adapt the sonographic procedure plan to optimize exam results.
   h. Determine if contrast media will enhance image quality and provide additional diagnostic information.
   i. Determine the need for additional accessory equipment or additional personnel.
   j. Modify sonographic procedure plan according to patient disease process and circumstances under which the procedure must be performed (i.e., operating room, ultrasound room, patient bedside, or emergency room).
   k. Modify sonographic procedure plan according to patient physical and mental status during the exam.
   l. Perform basic patient care tasks.
   m. Analyze sonographic findings throughout the exam, and perform measurements to provide accurate diagnosis for treatment plan.
   n. Confirm that the sonographic exam complies with applicable protocols and guidelines.
   o. Document sonographic exam results.

p. Notify the appropriate health-care provider when immediate medical attention is necessary.
q. Provide a written summary of preliminary sonographic findings.
r. Implement quality assurance within the ultrasound department.

5. Maintain patient care. DMSC1, DMSC2, DMSC7, DMSC9
   a. Work in partnership with other health-care professionals.
   b. Maintain appropriate professional credentials.
   c. Provide a diagnostic sonographic exam for the patient by applying professional judgment and discretion.
   d. Maintain continuing medical education on current issues in sonography.
   e. Identify personal strengths and use them to benefit patients, coworkers, and the profession.
   f. Perform diagnostic sonographic procedures in supervised clinical experiences.
   g. Communicate effectively with all members of the health-care team.
   h. Maintain patient confidentiality.
   i. Utilize standard precautions.

6. Use ultrasound equipment and accessory items. DMSC6, DMSC8
   a. Demonstrate use of ultrasound equipment.
   b. Scan and document findings in the ultrasound lab setting.
   c. Produce ultrasound images according to standards of care.
   d. Identify ultrasound scanning techniques.
   e. Use proper gain controls to produce diagnostic ultrasound images.
   f. Document total ultrasound scanning time in each procedure.
   g. Perform the required images for ultrasound abdominal scanning.
   h. Perform the required ultrasound images for obstetrical and gynecological scanning.

STANDARDS

CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography

DMSC1 Utilize oral and written communication.
DMSC2 Provide basic patient care and comfort.
DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.
DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.
DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.
DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.
DMSC7 Employ professional judgment and discretion.
DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.
DMSC9 Recognize the importance of continuing education.

DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.

DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.

DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns.

DMSD5 Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters.

DMSD6 Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology.

DMSD7 Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology.

DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)

A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS4 Health Literacy
CS7 Critical Thinking and Problem Solving
CS8 Communication and Collaboration
CS9 Information Literacy
CS11 ICT Literacy
CS12 Flexibility and Adaptability
CS13 Initiative and Self-Direction
CS14 Social and Cross-Cultural Skills
CS15 Productivity and Accountability
CS16 Leadership and Responsibility

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Course Name: Sectional Anatomy

Course Abbreviation: DMS 1213

Classification: Career-Technical Core

Description: This course provides students with ultrasound appearance of abdominal and pelvic sectional anatomy. It includes a description of gross sectional anatomy and identification of sonographic appearance of normal anatomy. (3 sch: 3-hr lecture)

Prerequisite: All core courses as scheduled

Competencies and Suggested Objectives
1. Describe the anatomy, physiology, and sonographic appearance of abdominal structures in cross-sectional longitudinal and transverse planes. DMSC1, DMSC3, DMSC4, DMSC5, DMS6, DMSC7, DMSD2, DMSD3, DMSD4 a. Describe the anatomy and sonographic appearance of the abdominal aorta. b. Describe the anatomy and sonographic appearance of the inferior vena cava. c. Describe the anatomy and sonographic appearance of the liver. d. Describe the anatomy and sonographic appearance of the gallbladder and biliary system. e. Describe the anatomy and sonographic appearance of the spleen. f. Describe the anatomy and sonographic appearance of kidneys. g. Describe the anatomy and sonographic appearance of the pancreas. h. Label abdominal structures on sonographic images in both longitudinal and transverse planes.
2. Describe the anatomy and physiology of female pelvic structures in cross-sectional longitudinal and transverse planes. DMSC1, DMSC3, DMSC7, DMSD2, DMSD4, DMSD6 a. Describe the anatomy and sonographic appearance of the uterus and pelvic cavity. b. Describe the anatomy and sonographic appearance of ovaries. c. Label female pelvic structures on sonographic images in both longitudinal and transverse planes.
3. Describe the anatomy, physiology, and sonographic appearance of obstetrical structures in cross-sectional longitudinal and transverse planes. DMSC1, DMSC3, DMSC7, DMSD2, DMSD5, DMSD7 a. Describe the anatomy and sonographic appearance of the pregnant uterus, placenta, cervix, ovaries, and associated structures. b. Describe the anatomy and sonographic appearance of a fetus during pregnancy. c. Label obstetrical structures on sonographic images in both longitudinal and transverse planes.
4. Describe the anatomy, physiology, and sonographic appearance of superficial structures in cross-sectional longitudinal and transverse planes. DMSC1, DMSC3, DMSC7, DMSD2, DMSD3, DMSD8 a. Describe the anatomy and sonographic appearance of adrenal glands. b. Describe the anatomy and sonographic appearance of the thyroid, parathyroid, and breasts. c. Describe the anatomy and sonographic appearance of the prostate and scrotum. d. Label small parts on sonographic images in both longitudinal and transverse planes.

STANDARDS

CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography

DMSC1 Utilize oral and written communication.
DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.
DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.
DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.
DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.
DMSC7 Employ professional judgment and discretion.
DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.
DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.
DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns.
DMSD5 Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters.
DMSD6 Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology.
DMSD7 Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology.
DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)

M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS4 Health Literacy
CS7 Critical Thinking and Problem Solving
CS8 Communication and Collaboration
CS9 Information Literacy
CS11 ICT Literacy

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American Institute of Ultrasound in Medicine. (n.d.). Retrieved May 10, 2011, from http://www.aium.org/

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Course Name: Ultrasound Physics and Instrumentation I

Course Abbreviation: DMS 1313

Classification: Career-Technical Core

Description: In-depth presentation of basic principles of diagnostic medical ultrasound physics and instrumentation. Description of diagnostic ultrasound transducers and ultrasound interaction with human tissue will be presented. (3 sch: 2-hr lecture, 2-hr lab)

Prerequisite: All core courses as scheduled

Competencies and Suggested Objectives
1. Discuss elementary principles of diagnostic medical sonography physics. a. Discuss the nature of ultrasound. DMSC1, DMSC5, DMSC6, DMSD1 b. Describe frequency, wavelength, and propagation speed as associated with ultrasound. c. Describe the properties of ultrasound waves. d. Describe decibel notation in relation to ultrasound. e. Describe physical units associated with diagnostic ultrasound. f. Describe measurement dimensions used in diagnostic ultrasound.
2. Describe propagation of ultrasound through tissues. DMSC1, DMSC5, DMSC6, DMSD1 a. Describe the speed of sound through human tissues. b. Describe reflection of ultrasound within human tissues. c. Describe refraction of ultrasound within human tissues. d. Describe attenuation of ultrasound within human tissues. e. Describe the useful range of frequencies in diagnostic ultrasound. f. Describe terminology of ultrasound image characteristics.
3. Describe the function of ultrasound transducers. DMSC1, DMSC5, DMSC6, DMSD1 a. Describe the piezoelectric effect. b. Identify transducer construction and characteristics. c. Describe ultrasound beam formation. d. Describe axial resolution of ultrasound beams. e. Describe lateral resolution of ultrasound beams. f. Describe slice thickness of ultrasound beams. g. Describe focusing methods of ultrasound transducers. h. Describe transducer arrays and image appearance of ultrasound transducers. i. Describe ultrasound transducer care and maintenance.
4. Describe pulsed-echo instrumentation of diagnostic ultrasound equipment. DMSC1, DMSC5, DMSC6, DMSD1 a. Describe the general concepts of the range equation as associated with diagnostic ultrasound. b. Describe pulsing characteristics of diagnostic ultrasound equipment. c. Describe the effects of output power of ultrasound transducers on ultrasound imaging. d. Describe the functions of the ultrasound receiver.
5. Describe the principles of diagnostic ultrasound pulsed-echo imaging. DMSC1, DMSC5, DMSC6, DMSD1

a. Describe principal display modes of diagnostic ultrasound imaging equipment.
b. Describe the principles of real-time, B-mode image formation of diagnostic medical ultrasound equipment.
c. Describe limitations of scanning speed of diagnostic medical ultrasound equipment.
d. Describe the principles of 3D/4D imaging.

STANDARDS

CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography

DMSC1 Utilize oral and written communication.
DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.
DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.
DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)

A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS4 Health Literacy
CS7 Critical Thinking and Problem Solving
CS8 Communication and Collaboration
CS9 Information Literacy
CS11 ICT Literacy

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Zagzebski, J. A. (1996). *Essentials of ultrasound physics*. St. Louis, MO: Mosby.

Course Name: Ultrasound Physics and Instrumentation II

Course Abbreviation: DMS 1323

Classification: Career-Technical Core

Description: A continuation of Ultrasound Physics and Instrumentation I (DMS 1313). This class includes an in-depth presentation of image display modes, Doppler, color, and hemodynamics of diagnostic ultrasound. The causes of artifacts and how to scan safely, conduct instrument performance measurements, and prepare for registry examinations. (3 sch: 2-hr lecture, 2 hr. lab)

Prerequisite: All core courses as scheduled

Competencies and Suggested Objectives
1. Describe images, storage, and display methods used in diagnostic medical ultrasound. DMSC1, DMSC5, DMSC6, DMSC7, DMSD1 a. Describe the role of the scan converter in diagnostic ultrasound imaging. b. Describe digital devices used in diagnostic ultrasound equipment. c. Describe pre- and post-processing functions of diagnostic medical ultrasound equipment. d. Describe the display devices used with diagnostic medical ultrasound equipment. e. Describe recording and archiving techniques employed in diagnostic medical ultrasound.
2. Describe Doppler instrumentation of diagnostic medical ultrasound. DMSC1, DMSC5, DMSC6, DMSC7, DMSD1 a. Describe hemodynamics. b. Describe the physical principles of Doppler ultrasound imaging. c. Describe continuous and pulsed wave Doppler instrumentation in diagnostic medical ultrasound. d. Describe color flow imaging in diagnostic ultrasound. e. Describe color power mode imaging in diagnostic ultrasound.
3. Discuss ultrasound artifacts. DMSC1, DMSC5, DMSC6, DMSC7, DMSD1 a. Define artifacts in ultrasound imaging. b. Describe artifacts associated with resolution of ultrasound waves in human tissues. c. Describe ultrasound artifacts associated with propagation of ultrasound waves in human tissues. d. Describe ultrasound artifacts associated with attenuation of ultrasound waves in human tissues. e. Describe artifacts associated with Doppler and color flow instrumentation in diagnostic ultrasound. f. Describe artifacts caused by electronic noise and equipment malfunction in diagnostic ultrasound. g. Describe the effects of artifacts on measurements in diagnostic ultrasound.
4. Perform performance and safety standards for ultrasound equipment. DMSC1, DMSC5, DMSC6, DMSC7, DMSC8, DMSD1

a. Discuss general concepts regarding the need for quality assurance in diagnostic ultrasound.
b. Discuss methods for evaluating ultrasound instrument performance.
c. Identify parameters to be evaluated in quality assurance of diagnostic medical ultrasound equipment.
d. Describe preventative maintenance of diagnostic ultrasound equipment.
e. Describe record keeping techniques involved with quality assurance in diagnostic ultrasound.
f. Discuss statistical indices associated with diagnostic ultrasound.

5. Describe bioeffects and safety of diagnostic ultrasound. DMSC1, DMSC3, DMSC5, DMSC6, DMSC8, DMSD1

a. Describe acoustic output quantities of diagnostic ultrasound.
b. Describe acoustic labeling standards for diagnostic ultrasound equipment.
c. Describe acoustic exposure of diagnostic ultrasound.
d. Describe primary mechanisms of biological effects of diagnostic ultrasound.
e. Describe experimental biological effect studies of diagnostic ultrasound.
f. Describe guidelines and regulations of diagnostic ultrasound equipment use.
g. Describe electrical and mechanical hazards associated with diagnostic ultrasound equipment.

STANDARDS

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DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.
DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.
DMSC7 Employ professional judgment and discretion.
DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.
DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
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M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS4 Health Literacy
CS7 Critical Thinking and Problem Solving
CS8 Communication and Collaboration
CS9 Information Literacy
CS11 ICT Literacy

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Course Name: Clinical Experience I

Course Abbreviation: DMS 1414

Classification: Career-Technical Core

Description: This class includes clinical instruction in the scanning lab and in clinical site institutions. Students will first receive hands-on experience in the scanning lab and then in clinical site rotations. (4 sch: 12-hr clinical)

Prerequisite: CPR certification; all core courses as scheduled

Competencies and Suggested Objectives
1. Obtain scanning experience in the program scanning lab. DMSC1, DMSC2, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8, DMSD1, DMSD2, DMSD3 a. Describe the ultrasound machine and accessories. b. Obtain ultrasound images. c. Operate ultrasound equipment. d. Discuss protocols for sonographic procedures at clinical sites. e. Develop a personal log of ultrasound exams performed/observed/assisted. f. Document guidelines for reporting diagnostic sonographic findings. g. Perform a mock sonographic exam.
2. Apply knowledge of ultrasound procedures in clinical site rotation. DMSC1, DMSC2, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8, DMSD1, DMSD2, DMSD3 a. Observe sonographers at clinical affiliates. b. Scan patients under the direct supervision of the sonographer. c. Demonstrate clinical site protocols for scanning, image documentation, record keeping, patient contact, and reporting procedures. d. Maintain a personal log of all ultrasound scans and procedures and the level of performance in each exam.
3. Demonstrate tasks associated with sonographic procedures. DMSC1, DMSC2, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8. DMSD1, DMSD2, DMSD3 a. Identify patient. b. Explain sonographic procedure to patient. c. Obtain patient history pertinent to ultrasound exam. d. Place patient in correct position(s) for a given sonographic procedure. e. Select ultrasound equipment to be used. f. Select proper scanning protocol for sonographic procedure. g. Image and measure specific areas of interest with ultrasound. h. Evaluate patient positioning and need for additional ultrasound imaging. i. Document sonographic diagnostic images. j. Demonstrate written and oral responses regarding ultrasound images. k. Dismiss patient after ultrasound exam is complete. l. Document sonographic exam results in proper logs. m. Prepare room for next sonographic exam. n. Maintain standard precautions.

4. Under direct supervision, perform clinical application skills for sonographic procedures of the abdominal wall and peritoneal space, gallbladder and biliary system, liver, pancreas, spleen, kidney, and abdominal vascular structures. DMSC1, DMSC2, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8. DMSD1, DMSD2, DMSD3. DMSD4
   a. Perform routine sonographic exam of the abdominal wall and peritoneal space.
   b. Perform routine sonographic exam of the gallbladder and biliary system.
   c. Perform routine sonographic exam of the liver, pancreas, spleen, and kidney.
   d. Perform routine sonographic exam of abdominal vascular structures.

STANDARDS

CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography

DMSC1 Utilize oral and written communication.
DMSC2 Provide basic patient care and comfort.
DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.
DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.
DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.
DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.
DMSC7 Employ professional judgment and discretion.
DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.
DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.
DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.
DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.
DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns.

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)

R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS4 Health Literacy
CS7 Critical Thinking and Problem Solving
CS8 Communication and Collaboration
CS9 Information Literacy
CS11 ICT Literacy
CS13 Initiative and Self-Direction
CS14 Social and Cross-Cultural Skills
CS15 Productivity and Accountability
CS16 Leadership and Responsibility

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Women's health resources for medical industry professionals. (n.d.). Retrieved May 10, 2011, from http://www.obgyn.net/

Course Name: Clinical Experience II

Course Abbreviation: DMS 1426

Classification: Career-Technical Core

Description: This course includes clinical practice and instruction in a clinical rotation site. (6 sch: 18-hr clinical)

Prerequisite: All core courses as scheduled

Competencies and Suggested Objectives
1. Under direct supervision, perform clinical application skills for sonographic procedures for first, second, and third trimester pregnancy; female pelvis; breast; male pelvis; and thyroid. DMSC1, DMSC2, DMSC3, DMSC7, DMSD1, DMSD2, DMSD3, DMSD4. DMSD5, DMSD6, DMSD7 a. Perform routine sonographic exam for first trimester pregnancy. b. Perform routine sonographic exam for second trimester pregnancy. c. Perform routine sonographic exam for third trimester pregnancy. d. Perform routine sonographic exam of the female pelvis. e. Perform routine sonographic exam of the breast. f. Perform routine sonographic exam of the male pelvis. g. Perform routine sonographic exam of the thyroid.
2. Under direct supervision, perform routine abdomen sonographic procedures. DMSC1, DMSC2, DMSC3, DMSC4, DMSC7, DMSD1, DMSD2, DMSD3, DMSD8 a. Perform routine sonographic exam of the gallbladder and biliary system. b. Perform routine sonographic exam of the liver, pancreas, and spleen. c. Perform routine sonographic exam of abdominal vascular structures. d. Perform routine sonographic exam of the abdominal wall and peritoneal space.

STANDARDS

CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography

DMSC1 Utilize oral and written communication.
DMSC2 Provide basic patient care and comfort.
DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.
DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.
DMSC7 Employ professional judgment and discretion.
DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.
DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.
DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns.
DMSD5 Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters.
DMSD6 Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology.
DMSD7 Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology.
DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)

L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS4 Health Literacy
CS7 Critical Thinking and Problem Solving
CS8 Communication and Collaboration
CS9 Information Literacy
CS11 ICT Literacy
CS13 Initiative and Self-Direction
CS14 Social and Cross-Cultural Skills
CS15 Productivity and Accountability
CS16 Leadership and Responsibility

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Course Name: Clinical Experience III

Course Abbreviation: DMS 1436

Classification: Career-Technical Core

Description: This course is a clinical practice and instruction in a clinical affiliate. Areas included are patient care and management, operation of equipment, and sonographic procedures. All procedures will be performed under direct supervision. (6 sch: 18-hr clinical)

Prerequisite: All core courses as scheduled

Competencies and Suggested Objectives
1. Perform clinical application skills for sonographic procedures for the gallbladder and biliary system, liver, pancreas, spleen, kidney, abdominal vascular structures, abdominal wall, and peritoneal space.[DMSC2, DMSC3, DMSC4, DMSC7, DMSD1, DMSD2, DMSD3, DMSD8] a. Perform routine sonographic exam of the gallbladder and biliary system. b. Perform routine sonographic exam of the liver, pancreas, spleen, and kidney. c. Perform routine sonographic exam of abdominal vascular structures. d. Perform routine sonographic exam of the abdominal wall and peritoneal space.
2. Perform clinical application skills for sonographic procedures for first, second, and third trimester pregnancy.[DMSC1, DMSC2, DMSC3, DMSC4, DMSC7, DMSD2, DMSD4, DMSD5, DMSD7] a. Perform routine sonographic exam for first trimester pregnancy. b. Perform routine sonographic exam for second trimester pregnancy. c. Perform routine sonographic exam for third trimester pregnancy.
3. Perform clinical application skills for sonographic procedures for the female pelvis, breast, male pelvis, and thyroid.[DMSC1, DMSC2, DMSC3, DMSC4, DMSC7, DMSD1, DMSD2, DMSD3, DMSD4, DMSD6] a. Perform routine sonographic exam of the female pelvis. b. Perform routine sonographic exam of the breast. c. Perform routine sonographic exam of the male pelvis. d. Perform routine sonographic exam of the thyroid.

STANDARDS

CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography

DMSC1 Utilize oral and written communication.
DMSC2 Provide basic patient care and comfort.
DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.
DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.
DMSC7 Employ professional judgment and discretion.
DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the

protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.

DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.

DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.

DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns.

DMSD5 Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters.

DMSD6 Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology.

DMSD7 Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology.

DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)

L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS4 Health Literacy
CS7 Critical Thinking and Problem Solving
CS8 Communication and Collaboration
CS9 Information Literacy
CS11 ICT Literacy
CS13 Initiative and Self-Direction
CS14 Social and Cross-Cultural Skills
CS15 Productivity and Accountability
CS16 Leadership and Responsibility

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Women's health resources for medical industry professionals. (n.d.). Retrieved May 10, 2011, from http://www.obgyn.net/

Course Name: Abdominal Sonography

Course Abbreviation: DMS 1513

Classification: Career-Technical Core

Description: Presentation of pathology/pathophysiology of abdominal anatomy including liver, kidneys, spleen, gallbladder, pancreas, and vascular structures associated with organs, as well as the abdominal cavities and the non-cardiac chest. Normal aging changes and laboratory values are presented. (3 sch: 3-hr lecture)

Prerequisite: All core courses as scheduled

Competencies and Suggested Objectives
1. Describe pathology/pathophysiology of abdominal cavity structures as presented on the sonographic exams. DMSC1, DMSC3, DMSC4, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8 a. Describe sonographic appearance of the abdominal wall and any associated pathology. b. Describe sonographic appearance of the peritoneal cavity and any related pathology. c. Describe the sonographic appearance of abdominal vascular structures and related pathology. d. Describe the sonographic appearance of the non-cardiac chest and associated pathology.
2. Describe pathology/pathophysiology of the liver and associated vascular structures as presented on the sonographic exams. DMSC1, DMSC3, DMSC4, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8 a. Discuss the development, location, size, vascular structures, and normal sonographic appearance of the liver and associated vascular and pathologic structures. b. Recognize the lobes of the liver sonographically. c. Recognize anatomic variations of the liver and associated vascular and pathologic structures sonographically. d. Discuss liver function tests and the relationship of these to sonographic examinations. e. Describe patient preparation, breathing instructions, positioning, scanning techniques, and pitfalls for sonography procedures involving the liver and associated vascular pathologic structures. f. Identify sonographic appearance of liver diseases, vascular abnormalities, cysts, hematomas, abscesses, infections, metastes, neoplasms, and liver transplants. g. Discuss other imaging procedures of the liver and associated vascular and pathologic structures.
3. Describe pathology/pathophysiology of the gallbladder and biliary system. DMSC1, DMSC3, DMSC4, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8 a. Discuss anatomy, variations, and physiology of the gallbladder and biliary system. b. Describe patient preparation, breathing instructions, and positioning for sonographic procedures involving the gallbladder and biliary system. c. Discuss indications, lab values, and the association with sonographic appearance for the gallbladder and biliary system. d. Describe sonographic appearance of variations of the gallbladder.

e. Describe the sonographic appearance of variations of the appearance of the gallbladder.
f. Describe acquired diseases of the gallbladder.
g. Discuss other imaging procedures of the gallbladder and biliary system.

4. Describe pathology/pathophysiology of the pancreas. DMSC1, DMSC3, DMSC4, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8

a. Discuss anatomy, location, and physiology of the pancreas.
b. Describe sectional views of the pancreas sonographically.
c. Discuss preparation and indications for pancreatic sonography.
d. Discuss sonographic appearance of pancreatic pathology, neoplasm, inflamation, and other abnormal findings.
e. Discuss pancreatic transplants.
f. Discuss related imaging procedures of the pancreas.

5. Describe pathology/pathophysiology of the spleen. DMSC1, DMSC3, DMSC4, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8

a. Discuss normal anatomy, variations, and physiology of the spleen.
b. Discuss the functions of the spleen.
c. Demonstrate normal sonographic appearance of the spleen.
d. Discuss ultrasound imaging techniques of the spleen.
e. Identify sonographic appearance of spleenic diseases, cysts, abscesses, infarcts, trauma, rupture, hematomas, calcifications, hemangiomas, and other abnormalities.

6. Describe pathology/pathophysiology of the renal system. DMSC1, DMSC3, DMSC4, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8

a. Discuss normal anatomy, variations, and physiology of the renal system.
b. Demonstrate normal sonographic appearance of the renal system.
c. Discuss ultrasound imaging techniques of the renal system.
d. Discuss sonographic appearance of renal system diseases, cysts, abscesses, trauma, calcifications, and other renal system pathology as well as laboratory values.
e. Discuss ultrasound procedures of renal transplants.
f. Describe sonographic appearance of pathology/pathophysiology of the adrenal glands.

7. Describe pathology/pathophysiology of the gastrointestinal tract. DMSC1, DMSC3, DMSC4, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8

a. Discuss location, anatomy, and physiology of the intestinal tract.
b. Demonstrate sonographic appearance of a normal and an abnormal bowel.
c. Describe appearance of the appendix on ultrasound.
d. Discuss ultrasound appearance of gastric and bowel obstruction and fluid collections.

STANDARDS

CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography

DMSC1 Utilize oral and written communication.
DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.
DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.
DMSC7 Employ professional judgment and discretion.

DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.
DMSC9 Recognize the importance of continuing education.
DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.
DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.
DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.
DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)

L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS4 Health Literacy
CS7 Critical Thinking and Problem Solving
CS8 Communication and Collaboration
CS9 Information Literacy
CS11 ICT Literacy
CS13 Initiative and Self-Direction
CS14 Social and Cross-Cultural Skills
CS15 Productivity and Accountability
CS16 Leadership and Responsibility

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Course Name: Obstetrical and Gynecological Sonography

Course Abbreviation: DMS 1523

Classification: Career-Technical Core

Description: This class discusses pathology/pathophysiology associated with female anatomy and obstetrical sonographic examinations. Sonographic appearance of the female pelvis premenopausal through postmenopausal and evaluation of pregnancy from conception to delivery will be discussed. Evaluating infertility and related laboratory values, as well as other imaging procedures, will be included. (3 sch: 3-hr lecture)

Prerequisite: All core courses as scheduled

Competencies and Suggested Objectives
1. Discuss ultrasound applications in obstetrical exams during the first trimester of pregnancy. DMSC1, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD3, DMSD4, DMSD5, DMSD6, DMSD7, DMSD8 a. Describe embryonic development. b. Describe ultrasound evaluation of first trimester pregnancy. c. Determine fetal age in the first trimester of pregnancy with ultrasound measurements. d. Define fetal life sonographically. e. Discuss laboratory tests utilized in first trimester pregnancies. f. Discuss abnormal first trimester pregnancies and correlate with ultrasound. g. Discuss clinical indications for ultrasound during the first trimester of pregnancy. h. Discuss transducer selection and patient preparation for first trimester ultrasound exam. i. Discuss the sonographer's role in talking with the patient and discussing sonographic results. j. Explain reporting sonographic results and sonographic videotaping procedures.
2. Describe ultrasound applications in obstetrical exams during the second and third trimester of pregnancy. DMSC1, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD3, DMSD5, DMSD7, DMSD8 a. Discuss normal fetal development during second and third trimesters of pregnancy. b. Discuss normal fetal ultrasound appearance in second and third trimesters of pregnancy. c. Discuss ultrasound fetal measurements in second and third trimesters of pregnancy. d. Discuss amniotic fluid measurements with ultrasound. e. Explain intrauterine growth restriction. f. Explain placental development. g. Discuss how maternal illness affects the developing fetus. h. Discuss genetic studies. i. Discuss fetal abnormalities seen on ultrasound examinations. j. Discuss multiple gestations. k. Discuss the biophysical fetal profile. l. Discuss clinical indications for ultrasound examination in second and third trimesters of pregnancy.

m. Discuss the sonographer's role in patient reporting and videotaping.
n. Discuss the postpartum appearance of the uterus on ultrasound exams.
o. Discuss intrauterine fetal therapy.
p. Discuss the role of the sonographer in invasive/interventional procedures.

3. Describe gynecological ultrasound evaluations. DMSC1, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD3, DMSD4, DMSD6, DMSD8

a. Describe normal pelvic anatomy.
b. Identify normal sonographic appearance of the female pelvis.
c. Identify sonographic appearance of congenital uterine malformations, ovarian masses, endometriosis, polycystic ovarian disease, pelvic inflammatory disease, and associated pathologies.
d. Discuss the role of sonography in the assessment of the infertility patient.
e. Discuss differential diagnosis of sonographic pelvic masses.
f. Identify uterine and ovarian disorders and masses sonographically.
g. Identify the sonographic appearance of contraceptive devices.

STANDARDS

CAAHEP Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography

DMSC1 Utilize oral and written communication.
DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.
DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.
DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.
DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.
DMSC7 Employ professional judgment and discretion.
DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.
DMSC9 Recognize the importance of continuing education.
DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.
DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.
DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns.

DMSD5 Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters.
DMSD6 Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology.
DMSD7 Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology.
DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS4 Health Literacy
CS7 Critical Thinking and Problem Solving
CS8 Communication and Collaboration
CS9 Information Literacy
CS11 ICT Literacy
CS13 Initiative and Self-Direction
CS14 Social and Cross-Cultural Skills
CS15 Productivity and Accountability
CS16 Leadership and Responsibility

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Course Name: Advanced Sonographic Procedures

Course Abbreviation: DMS 1533

Classification: Career-Technical Core

Description: Neurosonology, ophthalmology, adult cardiac, pediatric cardiac, and vascular technology will be discussed. Superficial structures scanning including prostate, thyroid, scrotum and breast will be included. (3 sch: 3-hr lecture)

Prerequisite: All core courses as scheduled

Competencies and Suggested Objectives
1. Describe pathology/pathophysiology of the thyroid, parathyroid, and associated vascular structures as presented on the sonographic exam. DMSC1, DMSC2, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8 a. Discuss sonographic indications and laboratory values associated with the thyroid. b. Discuss related imaging procedures for thyroid, parathyroid, and vascular structures of the neck. c. Describe sonographic appearance of cysts, masses, hematomas, and other pathology associated with the thyroid/parathyroid. d. Discuss sonographic protocols and procedures for thyroid, parathyroid, and vascular structures of the neck. e. Document patient history and physical findings. f. Communicate sonographic findings and verbal history given by the patient to physician. g. Identify vascular structures in the neck sonographically. h. Document blood flow, intravasculature structures, and pathology sonographically.
2. Describe pathology/pathophysiology appearance of the prostate as presented on the sonographic exam. DMSC1, DMSC2, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8 a. Discuss indications for prostate sonography. b. List prostate laboratory values and patient history. c. Identify prostate scanning techniques and protocols. d. Identify sonographic images of masses, cysts, abscesses, parenchymal disease, and benign hypertrophy. e. Document patient history and physical findings pertinent to ultrasound exam of prostate.
3. Describe sonographic appearance of pathology/pathophysiology of the scrotum. DMSC1, DMSC2, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8 a. Discuss scrotal scanning techniques and protocols. b. List scrotal laboratory values and patient history. c. Discuss clinical indications for ultrasound exam of scrotum. d. Identify sonographic images of masses, inflamation, cysts, fluid collections, hematomas, and parenchymal disease of scrotum. e. List all protocols for scrotal ultrasound imaging.

f. Document patient history and physical findings pertinent of ultrasound exam of scrotum.

4. Describe vascular sonography. DMSC1, DMSC2, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8
   a. Discuss vascular anatomy and indications for ultrasound examination.
   b. Discuss educational requirements for the vascular sonography registry.
   c. Describe sonographic appearance of normal vascular anatomy.
   d. Describe sonographic appearance of pathology of vascular structures.
   e. Identify protocols for vascular scanning techniques.
   f. Identify sonographic appearance of vascular pathology/pathophysiology.
5. Describe adult cardiovascular, pediatric cardiovascular, opthalmic, and neurological sonography. DMSC1, DMSC2, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8
   a. Discuss adult cardiac sonography.
   b. Discuss pediatric cardiac sonography.
   c. Discuss opthalmic sonography.
   d. Discuss neurosonography.
   e. Discuss educational requirements for adult cardiac, pediatric cardiac, opthalmic, and neurological sonography registries.
6. Describe normal and pathology/pathophysiology of the breast as presented on the sonographic exam. DMSC1, DMSC2, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8
   a. Discuss anatomy of the breast.
   b. Identify sonographic appearance of normal breast structures.
   c. Discuss sonographic appearance of breast masses.
   d. Discuss related breast imaging.
   e. Differentiate between whole breast imaging and imaging a palpable mass with ultrasound.
   f. Document patient positioning and measurements of masses for ultrasound imaging of the breast.
   g. Discuss patient history and clinical indications pertinent to ultrasound exam of breast.
   h. Discuss differential diagnosis of sonographic masses.
   i. Identify appearance of breast implants sonographically.

STANDARDS

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DMSC1 Utilize oral and written communication.
DMSC2 Provide basic patient care and comfort.
DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.
DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.
DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.

DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.
DMSC7 Employ professional judgment and discretion.
DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.
DMSC9 Recognize the importance of continuing education.
DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.
DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.
DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.
DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)

L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS4 Health Literacy
CS7 Critical Thinking and Problem Solving
CS8 Communication and Collaboration
CS9 Information Literacy
CS11 ICT Literacy
CS13 Initiative and Self-Direction
CS14 Social and Cross-Cultural Skills
CS15 Productivity and Accountability
CS16 Leadership and Responsibility

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Course Name: Sonography Seminar

Course Abbreviation: DMS 1613

Classification: Career-Technical Core

Description: This course will prepare students for ARDMS/ARRT certification examinations. (3 sch: 3-hr lecture)

Prerequisite: All core courses as scheduled

Competencies and Suggested Objectives
1. Review ultrasound physics and principles. DMSC1, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD8 a. Define diagnostic ultrasound. b. Discuss how ultrasound works to produce an image. c. Explain how ultrasound equipment turns sound into diagnostic images. d. Describe how Doppler ultrasound works. e. Describe ultrasound artifacts. f. Discuss performance and safety standards for ultrasound equipment. g. Perform simulated registries for ultrasound physics and instrumentation.
2. Examine all aspects of patient care. DMSC1, DMSC2, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD8 a. Describe patient care legal and professional responsibilities. b. Discuss patient education and safety. c. Explain patient care and standard precautions.
3. Discuss general sonographic procedures. DMSC1, DMSC2, DMSC3, DMSC4, DMSC7, DMSC9, DMSD1, DMSD2, DMSD3, DMSD4, DMSD5, DMSD6, DMSD7, DMSD8 a. Identify the sonographic anatomy, pathology, and physiology of the abdomen. b. Identify the sonographic anatomy, pathology, and physiology of obstetrics. c. Identify the sonographic anatomy, pathology, and physiology of gynecology. d. Identify general procedural considerations for abdominal sonography. e. Identify general procedural considerations for obstetrical sonography. f. Identify general procedural considerations for gynecological sonography. g. Perform simulated registries of abdomen, superficial structures, and obstetrical and gynecological sonography.

STANDARDS

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DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy.
DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology.

DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.
DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.
DMSC7 Employ professional judgment and discretion.
DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.
DMSC9 Recognize the importance of continuing education.
DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.
DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.
DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.
DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns.
DMSD5 Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters.
DMSD6 Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology.
DMSD7 Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology.
DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Related Academic Standards

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)
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M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)

M8 Percents
M9 Algebraic Operations
A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

21st Century Skills

CS4 Health Literacy
CS7 Critical Thinking and Problem Solving
CS8 Communication and Collaboration
CS9 Information Literacy
CS11 ICT Literacy
CS13 Initiative and Self-Direction
CS14 Social and Cross-Cultural Skills
CS15 Productivity and Accountability
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Course Name: Ultrasound Examination Critique

Course Abbreviation: DMS 1623

Classification: Career-Technical Core

Description: This course will present case studies of normal and abnormal sonographic exams. Students will attend presentations of guest lecturers. (3 sch: 3-hr lecture)

Prerequisite: All core courses as scheduled

Competencies and Suggested Objectives
1. Discuss obstetrical and gynecological case studies obtained in clinical site rotations. DMSC1, DMSC2, DMSC3, DMSC4, DMSC7, DMSC9, DMSD1, DMSD2, DMSD4, DMSD6, DMSD8 a. Discuss case studies pertaining to obstetrical sonography. b. Discuss case studies pertaining to gynecological sonography.
2. Discuss case studies pertaining to abdominal sonography. DMSC1, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD8 a. Discuss sonographic case studies of the abdominal wall. b. Discuss sonographic case studies of the liver. c. Discuss sonographic case studies of the gallbladder and biliary system. d. Discuss sonographic case studies of the pancreas. e. Discuss sonographic case studies of the spleen. f. Discuss sonographic case studies of the renal system. g. Discuss sonographic case studies of the gastrointestinal system.
3. Review abdominal, obstetrical, and gynecological sonography case studies from clinical site rotations. DMSC1, DMSC3, DMSC4, DMSC5, DMSC6, DMSC7, DMSC8, DMSC9, DMSD1, DMSD2, DMSD3, DMSD4, DMSD5, DMSD6, DMSD7, DMSD8 a. Discuss abdominal sonographic case studies. b. Discuss obstetrical sonographic case studies. c. Discuss gynecologic sonographic case studies. d. Critique case studies associated with abdominal, obstetrical, and gynecological sonography.

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DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation.

DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations.
DMSC7 Employ professional judgment and discretion.
DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory.
DMSC9 Recognize the importance of continuing education.
DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes.
DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns.
DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis.
DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns.
DMSD5 Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters.
DMSD6 Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology.
DMSD7 Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology.
DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Related Academic Standards

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M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations

A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)
L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)
S1 Vowel (short, long)
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21st Century Skills

CS4 Health Literacy
CS7 Critical Thinking and Problem Solving
CS8 Communication and Collaboration
CS9 Information Literacy
CS11 ICT Literacy
CS13 Initiative and Self-Direction
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CS15 Productivity and Accountability
CS16 Leadership and Responsibility

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Recommended Tools and Equipment

CAPITALIZED ITEMS

1. General Purpose Ultrasound Phantom (1 per lab)
2. Doppler Ultrasound Phantom (1 per lab)
3. AIUM 100 mm Test Object (1 per lab)
4. Beam Profile/Slice Thickness Phantom (1 per lab)
5. Ultrasound Scanning Table (1 per lab)
6. Ultrasound Machine (1 per lab)
7. 3.5 Megahertz Probe (1 per machine)
8. 7.0 Megahertz Transvaginal Probe (1 per machine)
9. 10.0 Megahertz Probe (1per machine)
10. 3-D Probe (1 per machine)
11. Color Printer (for Ultrasound Machine) (1 per lab)
12. Computers (1 per student)
13. Wheelchair (1 per lab)
14. Illuminators, Mobile Stand System (1 per 5 students)
15. Power Point System/Boxlight Projection System (1 per lab)
16. Stretcher (1 per lab)
17. Cross Sectional Model (1 per lab)
18. High Intensity Overhead Projector (1 per lab)
19. UltraSim (1 per lab)
20. Washer/Dryer (1 per lab)
21. Sectional Torso (1 per lab)
22. Kidney Model (1 per lab)
23. Classic Pregnancy Series Model (1 per lab)
24. Male Pelvis Model (1 per lab)
25. Female Pelvis Model (1 per lab)
26. Liver Model (1 per lab)
27. Thermal Printer (for Ultrasound Machine) (1 per lab)

NON-CAPITALIZED ITEMS

1. Supply Storage Cabinet (1 per program)
2. Laser Printer (1 per lab)
3. Sheets (48)
4. Pillow (1 per ultrasound table)
5. Pillow Cases
6. Step Stool (1 per lab)
7. Adjustable Stool (1 per lab)
8. Cut Film Holders (6 per lab)
9. Digital Camera
10. Towels (shop type) (50)

RECOMMENDED INSTRUCTIONAL AIDS

It is recommended that instructors have access to the following items:

1. Scanner
2. TV
3. DVD Player

CONSUMABLE SUPPLIES

These supplies are to be provided on an annual basis (a local level responsibility).

1. Ultrasound Gel
2. Disinfectants
3. Paper for Printer
4. Table Paper
5. Laundry Detergent
6. Disposable Exam Gloves

Appendix A: Standards and Guidelines for the Accreditation of Educational Programs in Diagnostic Medical Sonography[1]

C. Required Competencies Common to Each Learning Concentration

DMSC1 Utilize oral and written communication:

a. Maintain clinical records.
b. Interact with the interpreting physician or other designated physicians with oral or written summary of findings as permitted by employer policy and procedure.
c. Recognize significant clinical information and historical facts from the patient and the medical records, which may impact on the diagnostic examination.
d. Comprehend and employ appropriate medical terminology, abbreviations, symbols, terms, and phrases.
e. Educate other health-care providers and the public in the appropriate applications of ultrasound/non-invasive diagnostic vascular evaluation, including the following:
Medical terminology
Sonographic/other non-invasive diagnostic vascular terminology
Pertinent clinical signs, symptoms, and laboratory tests
Pertinent legal principles

DMSC2 Provide basic patient care and comfort:

a. Maintain infection control and utilize universal precautions.
b. Anticipate and be able to respond to the needs of the patient.
c. Identify life-threatening situations and implement emergency care as permitted by employer procedure, including the following:
Infection control and universal precaution procedures
Pertinent patient care procedures
Principles of psychological support
Emergency conditions and procedures
First aid and resuscitation techniques

DMSC3 Demonstrate knowledge and understanding of human gross and sectional anatomy:

a. Evaluate anatomic structures in the region of interest.
b. Recognize the sonographic appearance of normal tissue structures, including the following:
Gross sectional anatomy
Embryology
Normal sonographic patterns

[1] Douglass, E. B., Atchley, R. C., David, D. D., & Wendt, P. F. (Eds.). (2007). *Standards and guidelines for diagnostic medical sonography programs* (3rd ed.). Washington, DC: Association for Diagnostic Medical Sonography in Education.

DMSC4 Demonstrate knowledge and understanding of physiology, pathology, and pathophysiology:

a. Obtain and evaluate pertinent patient history and physical findings.
b. Extend standard diagnostic testing protocol as required by patient history or initial findings.
c. Review data from current and previous examinations to produce a written/oral summary of technical findings, including relevant interval changes, for the interpreting physician's reference.
d. Recognize examination findings that require immediate clinical response and notify the interpreting physician of such findings, including the following:
Patient interview and examination techniques
Chart and referral evaluation
Diagnostic testing protocols related to specific disease conditions
Physiology including blood flow dynamics
Pertinent pathology and pathophysiology
Pertinent legal issues

DMSC5 Demonstrate knowledge and understanding of acoustical physics, Doppler ultrasound principles, and ultrasound instrumentation:

a. Select the appropriate technique(s) for examination(s) being performed.
b. Adjust instrument controls to optimize image quality.
c. Perform linear, area, circumference, and other related measurements from sonographic images or data.
d. Recognize and compensate for acoustical artifacts.
e. Utilize hard-copy devices to obtain pertinent documentation of examination findings.
f. Minimize patient exposure to acoustical energy, which includes the following:
Acoustical physics
Sound production and propagation
Interaction of sound and matter
Instrument options and transducer selection
Principles of ultrasound instruments and modes of operation
Operator control options
Physics of Doppler
Principles of Doppler techniques
Methods of Doppler flow analysis
Techniques for recording static and dynamic images
Acoustical artifacts

DMSC6 Demonstrate knowledge and understanding of the interaction between ultrasound and tissue and the probability of biological effects in clinical examinations, including the following:

Biologic effects
Pertinent in-vitro and in-vivo studies

DMSC7 Employ professional judgment and discretion:

a. Protect the patient's right to privacy.
b. Maintain confidentiality.
c. Perform within the scope of practice.
d. Adhere to the professional codes of conduct/ethics through the following:
   Medical ethics
   Pertinent legal principles
   Professional interaction skills
   Professional scopes of practice

DMSC8 Understand the fundamental elements for implementing a quality assurance and improvement program, and the policies, protocols, and procedures for the general function of the ultrasound laboratory, including the following:

Administrative procedures
Quality control procedures
Elements of quality assurance program
Records maintenance
Personnel and fiscal management
Trends in health care systems

DMSC9 Recognize the importance of continuing education, through the following:

Professional journals
Conferences
Lectures
In-house educational offerings
Professional organizations and resources
Recent developments in sonography
Research statistics and design

D. Competencies Specific to the General Learning Concentration Shall Include, but not be Limited to the Following:

DMSD1 Demonstrate the ability to perform sonographic examinations of the abdomen, superficial structures, non-cardiac chest, and the gravid and nongravid pelvis according to protocol guidelines established by national professional organizations and the protocol of the employing institution utilizing real-time equipment with both transabdominal and endocavitary transducers, Doppler, and color Doppler display modes:

Demonstration/laboratory sessions
Clinical education

DMSD2 Recognize and identify the sonographic appearance of normal anatomic structures, including anatomic variants and normal Doppler patterns:

Liver
Biliary system
Pancreas

Urinary tract
Adrenal glands
Spleen
Prevertebral vessels
Peritoneal cavity, including potential spaces
Gastrointestinal tract
Noncardiac chest
Neck
Breast
Scrotum
Prostate
Anterior abdominal wall
Extremities
Brain and spinal cord

DMSD3 Recognize, identify, and appropriately document the abnormal sonographic and Doppler patterns of disease processes, pathology, and pathophysiology of the structures listed above. Modify the scanning protocol based on the sonographic findings and the differential diagnosis:

History and physical examination
Related imaging, laboratory, and functional testing procedures
Clinical differential diagnosis
Role of ultrasound in patient management
Sonographic and Doppler patterns in clinical diseases which may occur in the following categories:
- *Iatrogenic*
- *Degenerative*
- *Inflammatory*
- *Traumatic*
- *Neoplastic*
- *Infectious*
- *Obstructive*
- *Congenital*
- *Metabolic*
- *Immunologic*

DMSD4 Recognize and identify the sonographic appearance of normal anatomic structures of the female pelvis, including anatomic variants and normal Doppler patterns:

Reproductive system
Pelvic muscles
Suspensory ligaments
Peritoneal spaces
Pelvic vasculature

DMSD5 Recognize and identify the sonographic appearance of normal maternal, embryonic, and fetal anatomic structures during the first, second, and third trimesters:

Sonographic sectional anatomy
Pertinent measurement techniques
Doppler applications
Normal sonographic appearance of fetal and maternal structures

DMSD6 Recognize, identify, and appropriately document the sonographic appearance of gynecologic disease processes, pathology, and pathophysiology:

History and physical examination
Related imaging, laboratory, and functional testing procedures
Differential diagnosis
Role of ultrasound in patient management
Abnormal sonographic patterns in pregnancy:
Iatrogenic
Degenerative
Inflammatory
Traumatic
Neoplastic
Infectious
Obstructive
Congenital
Metabolic
Immunologic
Contraceptive devices
Infertility procedures
Doppler applications

DMSD7 Recognize, identify, and appropriately document the sonographic appearance of obstetric abnormalities, disease, pathology, and pathophysiology:

History and physical examination
Related imaging, laboratory, and functional testing procedures
Differential diagnosis
Role of ultrasound in patient management
Abnormal sonographic patterns in pregnancy:
Placenta
Congenital/genetic anomalies
Growth abnormalities
Amniotic fluid
Viability
Multiple gestation
Fetal monitoring
Maternal factors
Postpartum
Fetal therapy

DMSD8 Demonstrate knowledge and understanding of the role of the sonographer in performing interventional/invasive procedures.

Appendix B: Related Academic Standards[2]

Reading

R1 Interpret Graphic Information (forms, maps, reference sources)
R2 Words in Context (same and opposite meaning)
R3 Recall Information (details, sequence)
R4 Construct Meaning (main idea, summary/paraphrase, compare/contrast, cause/effect)
R5 Evaluate/Extend Meaning (fact/opinion, predict outcomes, point of view)

Mathematics Computation

M1 Addition of Whole Numbers (no regrouping, regrouping)
M2 Subtraction of Whole Numbers (no regrouping, regrouping)
M3 Multiplication of Whole Numbers (no regrouping, regrouping)
M4 Division of Whole Numbers (no remainder, remainder)
M5 Decimals (addition, subtraction, multiplication, division)
M6 Fractions (addition, subtraction, multiplication, division)
M7 Integers (addition, subtraction, multiplication, division)
M8 Percents
M9 Algebraic Operations

Applied Mathematics

A1 Numeration (ordering, place value, scientific notation)
A2 Number Theory (ratio, proportion)
A3 Data Interpretation (graph, table, chart, diagram)
A4 Pre-Algebra and Algebra (equations, inequality)
A5 Measurement (money, time, temperature, length, area, volume)
A6 Geometry (angles, Pythagorean theory)
A7 Computation in Context (whole numbers, decimals, fractions, algebraic operations)
A8 Estimation (rounding, estimation)

Language

L1 Usage (pronoun, tense, subject/verb agreement, adjective, adverb)
L2 Sentence Formation (fragments, run-on, clarity)
L3 Paragraph Development (topic sentence, supporting sentence, sequence)
L4 Capitalization (proper noun, titles)
L5 Punctuation (comma, semicolon)
L6 Writing Conventions (quotation marks, apostrophe, parts of a letter)

Spelling

S1 Vowel (short, long)
S2 Consonant (variant spelling, silent letter)
S3 Structural Unit (root, suffix)

[2] CTB/McGraw-Hill LLC. (2005). *Tests of adult basic education, forms 9 and 10.* Monterey, CA: Author.

Appendix C: 21st Century Skills[3]

CSS1-21st Century Themes

CS1 Global Awareness

1. Using 21st century skills to understand and address global issues
2. Learning from and working collaboratively with individuals representing diverse cultures, religions and lifestyles in a spirit of mutual respect and open dialogue in personal, work and community contexts
3. Understanding other nations and cultures, including the use of non-English languages

CS2 Financial, Economic, Business and Entrepreneurial Literacy

1. Knowing how to make appropriate personal economic choices
2. Understanding the role of the economy in society
3. Using entrepreneurial skills to enhance workplace productivity and career options

CS3 Civic Literacy

1. Participating effectively in civic life through knowing how to stay informed and understanding governmental processes
2. Exercising the rights and obligations of citizenship at local, state, national and global levels
3. Understanding the local and global implications of civic decisions

CS4 Health Literacy

1. Obtaining, interpreting and understanding basic health information and services and using such information and services in ways that enhance health
2. Understanding preventive physical and mental health measures, including proper diet, nutrition, exercise, risk avoidance and stress reduction
3. Using available information to make appropriate health-related decisions
4. Establishing and monitoring personal and family health goals
5. Understanding national and international public health and safety issues

CS5 Environmental Literacy

1. Demonstrate knowledge and understanding of the environment and the circumstances and conditions affecting it, particularly as relates to air, climate, land, food, energy, water and ecosystems
2. Demonstrate knowledge and understanding of society's impact on the natural world (e.g., population growth, population development, resource consumption rate, etc.)
3. Investigate and analyze environmental issues, and make accurate conclusions about effective solutions
4. Take individual and collective action towards addressing environmental challenges (e.g., participating in global actions, designing solutions that inspire action on environmental issues)

CSS2-Learning and Innovation Skills

CS6 Creativity and Innovation

1. Think Creatively
2. Work Creatively with Others
3. Implement Innovations

CS7 Critical Thinking and Problem Solving

1. Reason Effectively
2. Use Systems Thinking
3. Make Judgments and Decisions
4. Solve Problems

CS8 Communication and Collaboration

1. Communicate Clearly
2. Collaborate with Others

[3] *21st century skills.* (n.d.). Washington, DC: Partnership for 21st Century Skills.

CSS3-Information, Media and Technology Skills

CS9 Information Literacy
1. Access and Evaluate Information
2. Use and Manage Information

CS10 Media Literacy
1. Analyze Media
2. Create Media Products

CS11 ICT Literacy
1. Apply Technology Effectively

CSS4-Life and Career Skills

CS12 Flexibility and Adaptability
1. Adapt to Change
2. Be Flexible

CS13 Initiative and Self-Direction
1. Manage Goals and Time
2. Work Independently
3. Be Self-directed Learners

CS14 Social and Cross-Cultural Skills
1. Interact Effectively with Others
2. Work Effectively in Diverse Teams

CS15 Productivity and Accountability
1. Manage Projects
2. Produce Results

CS16 Leadership and Responsibility
1. Guide and Lead Others
2. Be Responsible to Others